WATERSHED WORK PLAN

FOR

WATERSHED PROTECTION

AND

FLOOD PREVENTION

WILLOW CREEK - PARK RIVER WATERSHED

CAVALIER, PEMBINA AND WALSH COUNTIES, NORTH DAKOTA

AUGUST 1964

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WATERSHED WORK PLAN

WILLOW CREEK-PARK RIVER WATERSHED

Cavalier, Pembina, and Walsh Counties, North Dakota

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666) as amended.

Prepared by

Three Rivers Soil Conservation District
East Pembina Soil Conservation District
West Pembina Soil Conservation District
Cavalier County Soil Conservation District
Pembina County Water Management District
Walsh County Water Management District

With Assistance by

U. S. Department of Agriculture, Soil Conservation Service
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SUMMARY OF PLAN

The Willow Creek-Park River Watershed contains 118,460 acres located in Cavalier, Pembina and Walsh Counties in northeastern North Dakota.

The project for watershed protection, flood prevention, agricultural water management, and fish and wildlife development is sponsored by the Three Rivers, East Pembina, West Pembina, and Cavalier County Soil Conservation Districts, and the Pembina County and Walsh County Water Management Districts.

The principal problem is flooding of agricultural land by overtopping existing channel banks and flowing across the extensive flat land areas in the watershed.

The project proposes land treatment and structural measures that, when installed, will reduce average annual damages by 72 percent.

Structural measures proposed are one floodwater retarding structure and 56.1 miles of channel improvement for flood prevention and agricultural water management. One lake level control structure is proposed to allow management of the lake for wildlife.

The project measures will be installed in five years.

The total project cost is $1,991,870. The P.L. 566 share is $1,381,289. The share of the cost other than from P. L. 566 funds (hereinafter referred to as "Other") is $610,581.

Land owners and operators will install and maintain land treatment measures under agreement with their Soil Conservation District. The estimated cost is $272,230. P.L. 566 funds amounting to $47,378 will be provided to accelerate the rate of installation of land treatment measures.

The floodwater retarding structure, channel improvement, and the lake level control structure will be installed through contracts let by the Water Management Districts.

The cost of the structural works is $1,719,640. The P.L. 566 share is $1,333,911; the Other funds share is $385,729. The Other funds include total cost of land, easements, and rights-of-way $362,945, which includes bridges and culverts at $116,905; administration of contracts $2,500; and the local funds share of the construction cost $20,284.

The Water Management Districts will be responsible for the maintenance of all structural measures. The State Game and Fish Department will assist in the operation and maintenance of the lake area for wildlife. This will be covered by an agreement between the Game and Fish Department and the concerned Water Management District. The estimated average annual operation and maintenance cost of all structures is $12,935. Included is $144 for average annual operation and maintenance of the North Salt Lake development.

The average annual primary benefit attributed to structures for flood prevention and agricultural water management is estimated to be $179,111. The average annual cost of structural measures for flood prevention and agricultural water management is estimated to be $78,119 resulting in a benefit to cost ratio of 2.3 to 1. The inclusion of secondary benefits results in a benefit cost ratio of 2.6 to 1.

DESCRIPTION OF WATERSHED

Physical Data

The Willow Creek-Park River Watershed, located in Pembina, Walsh and Cavalier Counties in northeast North Dakota, contains 118,460 acres. The Park River Watershed is divided into four areas for planning purposes. The Willow Creek-Park River Watershed is the first of these areas to be planned.

Willow Creek has its source in the glaciated Pembina escarpment uplands and flows eastward and southward across the floodplain to its junction with the mainstem of the Park River about six miles northeast of Grafton, North Dakota. Willow Creek has a definite channel as it leaves the glaciated escarpment and where it cuts through the beachlines of former glacial Lake Agassiz. The channel has very low capacity where it traverses the broad, level lake plain.

Six to eight miles northeast of Grafton are two shallow lakes which are utilized by waterfowl. These are Salt Lake and North Salt Lake.

The watershed is long and narrow. It is about 44 miles long and varies from 3 to 7 miles in width. Elevations range from approximately 1,400 feet above sea level at the headwaters to about 760 feet at the Red River of the North.

The watershed lies within the western lake section of the central lowlands province, an area of glacial drift and lacustrine plains formed by continental ice sheets during the Wisconsin stage of ice invasion. With the exception of the glaciated Pembina escarpment on the western edge of the watershed, the area is characterized by features associated with former glacial Lake Agassiz--broad, level, lacustrine plains with an occasional beach line.

The soils in the watershed range from sandy loams to clay loams and clays. Most of the soils not suitable for cultivation are in the escarpment area or on the beaches.

Land use and crop distribution in the watershed follows:

Land Use	Acres	Per Cent
Cropland		
Small Grain	74,867	63.2
Row Crop	19,191	16.2
Legume	2,606	2.2
Summer Fallow	14,215	12.0
Subtotal	110,879	93.6
Grassland and Woodland	1,540	1.3
Other (roads, railroads, streams, lakes, towns, and farmsteads)	6,041	5.1
Total	118,460	100.0

The climate has wide seasonal variations. Records at the Grafton weather station, within the Park River system, show mean monthly temperatures varying from 69 degrees in the summer to 3.5

degrees in the winter. The maximum recorded temperature is 108 degrees and the minimum is 47 degrees below zero. The average date of the last killing frost is May 22 and the earliest is September 17. The growing season averages 118 days. However, the long hours of summer sunshine in this latitude make it possible to grow and mature many different crops. The average annual precipitation is 18.7 inches. The minimum was 10.8 inches in 1910, and the maximum was 27.9 inches in 1909. The mean annual snowfall at Grafton is 37.2 inches, which is approximately 3.7 inches of precipitation. In most years snowmelt runoff causes damaging floods during March, April or May. Excess rainfall runoff causes damaging floods during May through September.

Water is obtained from shallow aquifers in the lacustrine sediments and aquifers in the glacial till underlying the lake sediments. The quality of some of the water is poor.

Economic Data

Farming is the major enterprise in the watershed. Over sixty per cent of the land is devoted to small grain production while potatoes and sugar beets account for about another 16 per cent of the area.

A new sugar beet plant is under construction at Drayton, North Dakota, about four miles east of the watershed. An acreage of beets has been allocated to this plant which will more than double the present acreage.

Potato raising has developed into a major industry with some producers having in excess of 400 acres. The two towns within the

watershed proper--Hensel, population 130, and St. Thomas, population 660--accounted for 1,950 carloads of potatoes being shipped to eastern markets in 1960. These potato warehouses provide winter employment for a substantial number of people.

Woodland is limited to field and farmstead windbreaks and about 100 acres of brush in the upper reaches of the watershed. There are small areas of grassland along the upper part of the channel. All the land is privately owned. Current land values vary from $100 to $250 per acre. There are 206 farms in the watershed. Eighty-four percent of the farmers own all or part of their farms.

According to the 1959 Agricultural Census land values have increased as shown in the following table.

	Walsh County	Pembina County
1950	$ 61.13	$ 62.04
1954	72.87	79.06
1959	109.71	115.10

The size of the average farm has increased accordingly:

1950	382.7	410.8
1954	402.3	437.3
1959	450.6	503.1

Population of Pembina County is 13,000 with over 50 percent of the people living in cities and villages. Many farmers maintain homes in the towns near the schools and live temporarily on the farms during the summer. This can be done as only 10 percent of the farm income comes from livestock. Most of the livestock is found in the escarpment and pothole areas above the floodplain in the western part of the counties. Grafton, population 5,885, 5 miles south of the watershed

and Cavalier, population 1,423, 8 miles north of the watershed, are the county seats of Walsh and Pembina Counties respectively. These towns are the principal shopping centers for the watershed.

Land use in the floodplain is as follows:

Crop	Percent of Land
Wheat	23.7
Oats	5.5
Barley	26.9
Flax	6.3
Potatoes	13.2
Sugar Beets	2.9
Alfalfa	2.7
Summer Fallow	12.4
Noncropland--roads, farmsteads, etc	6.4
Total	100.0

WATERSHED PROBLEMS

Floodwater Damage

The maximum area flooded as determined through field interviews is 25,525 acres of which 23,000 is cropland. This would be the area flooded by the 1948 and 1950 snowmelt runoff events and by the September 1957 rainfall storm.

The existing channels are not big enough to carry the excess runoff. These channels are crossed by graded highways that have inadequate bridges and culverts. These restrictions cause large areas to be flooded. Because of the flat terrain, floodwaters cover large areas and deposit noxious weed seeds which account for other agricultural damage. Bridges, roads, and culverts are often washed out requiring extra time to detour around these washouts.

Damage from snowmelt and rainfall runoff often occurs during the same year.

Floods from snowmelt runoff cause a delay in seeding crops. Any delay beyond the normal seeding date of crops in this area of short growing seasons results in a significant reduction in yields. The micro-relief, abundance of small depressions, when wet, make it impractical to operate machinery on the irregular pattern of associated dry areas. Consequently even minor overflow and minor area flooded has impact on larger areas of the delineated floodplain.

Floods from summer storms that exceed channel capacity cause damage to growing crops. Potatoes are especially sensitive to flood-water as 36 hours of inundation can cause a 100 percent loss. Other crops are also damaged from short periods of inundation, resulting in lower yields and poorer quality. Swathed grain can be a total loss from a few hours of flooding.

The September 1957 flood event resulted in several thousand acres of potatoes, sugar beets, and flax being lost.

Sediment Damage

Interviews with land owners and field spot checks indicate that major floods deposit a small amount of sediment in localized areas. The sediment is usually fertile and damages are negligible.

Wind deposited sediment in channels is a problem. Deposits restrict the free flow of water and aggravate the flood problem. This accumulation necessitates the expenditure of funds for cleanout purposes and demonstrates the need for land treatment measures to prevent sediment accumulation.

Erosion Damage

Sheet scouring of isolated cultivated fields occurs during the spring runoff. The scoured areas are not large and damages are considered negligible. Sheet erosion occurs on the steeper slopes. Fields lacking protective measures are damaged by wind erosion. An accelerated land treatment program provides the best solution to the erosion problems, including the prevention of deposition of wind borne sediment in channels. The combined effect of sheet and wind erosion may adversely affect the structural program by reducing channel capacities.

Problems Relating to Water Management

Small depressional areas are dispersed throughout the floodplain area. These areas sustain damages from both floodwater inundation and prolonged wetness. These areas are considered to have a dual problem of flooding and drainage.

Generally, an adequate quantity of water is available for livestock from artesian wells. This water is not always potable and some of the farms and communities in the watershed haul water for domestic use. Interest in developing community water supplies as part of this project was expressed. However, no feasible sites were found.

PROJECTS OF OTHER AGENCIES

The Corps of Engineers is working jointly with the Service in the development of a plan for the Park River Basin. Works of improvement in this plan for Willow Creek will be in harmony with proposed works of improvement in the Park River Basin.

There are no authorized county, state, or Federal water resource projects in the Willow Creek Watershed which would be adversely affected by the work plan.

BASIS FOR PROJECT FORMULATION

The primary purpose of the project is to reduce flooding of farm land from stream overflow.

Because of the topography of the watershed, it was known that few, if any, retarding structure sites would be available. It was therefore decided a level of protection equal to that provided by "M" curve drainage design capacity would be developed with channel improvement and retardation if sites could be found. Evaluation of various channel sizes in previously developed work plans for other watersheds in the Red River Valley indicated that channel capacity based on the "M" curve most nearly meets the level of protection mutually acceptable to the sponsors and to the Service.

One floodwater retarding site was found and is included in the plan.

Channel improvement with design capacities adequate to provide the desired level of protection to flooded areas is also included in the plan.

When planning was authorized some local people as well as the Federal Fish and Wildlife Service and State Game and Fish Department expressed the desire to enhance the North Salt Lake for waterfowl use, if possible.

As planning progressed it was determined that channel improvement "C" could be routed through this lake. This made it possible to develop the North Salt Lake area for waterfowl habitat.

Public hunting will be allowed in season in an area of the state where no public hunting area now exists.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures for Watershed Protection

The installation of land treatment measures is considered essential to an effective watershed protection and flood prevention program. Land treatment measures proposed in this work plan, when installed, will exceed minimum requirements. The following districts--Three Rivers, East Pembina, West Pembina, and the Cavalier County Soil Conservation Districts--are presently engaged in this activity under going programs. The Agricultural Stabilization and Conservation Service can assist in the accelerated land treatment by providing increased ACP funds within the watershed.

Emphasis under the Watershed Protection and Flood Prevention Program is on accelerating the establishment of those land treatment measures that have a measurable effect in reducing runoff and sediment production. Particular emphasis will be given to the application of land treatment measures necessary to control wind erosion and reduce wind borne sediment deposition in the channels.

Land owners will be encouraged to preserve and improve habitat through good land use programs and to make use of the ACP program available for wildlife practices.

Cover cropping and crop residue use measures will reduce erosion hazards, help maintain organic matter and soil tilth, and increase the water holding capacity of the soil. Field windbreaks will be planted to protect soil resources and control snow that might be deposited in the channels and in surface ditches.

On-farm surface field ditches will be installed to convey flood flows back to channels. These on-farm water disposal systems will be accelerated above the going rate so that at least 72 percent of the disposal systems will be installed by the end of the construction period. These ditches are needed to fully realize the benefits of the structural works of improvement.

Technical assistance for the forestry measures will be furnished by the North Dakota Forest Service in cooperation with the U.S. Forest Service under the going Cooperative Forest Management Program.

Improved forestry practices and sustained yield practices are the measures to be applied.

The estimated amount of the land to be treated during the project installation period and the estimated costs are shown in Table 1.

Structural Measures

One floodwater retarding structure will be installed. The structure will control a drainage area of 18.9 square miles which is 10.2 percent of the watershed area. This structure will provide 2,488 acre feet of flood water storage. This capacity is adequate to control the snowmelt runoff from an event that can be expected once in 25 years.

Provision for 152 acre feet of sediment storage will accommodate the sediment expected to accumulate in 50 years.

The structure will be an earth fill with a reinforced concrete drawdown pipe to serve as a principal spillway. A vegetated emergency spillway will be provided to pass runoff exceeding the detention capacity of the reservoir.

The total cost of the structure is estimated at $405,749.

A total of 56.1 miles of channel improvement will be constructed. The channel improvement is confined to the major damage areas of the watershed. The channel improvement has been divided into three segments or reaches (see Project Map). All channel improvements will be designed with "M" curve capacity.

Channel improvement "A" is 38.6 miles long. The improvement will vary from major enlargement to minor cleanout of the existing water course of Willow Creek. Principal spillway discharge from the floodwater retarding structure will be added to the "M" curve design capacity for channel "A".

Channel improvement "B" is 4.3 miles long and will consist of enlarging the existing Willow Creek channel and one tributary channel.

Channel improvement "C" is 13.2 miles long and will flow through North Salt Lake. Improvements in the reach above the lake consist of constructing a new channel to provide an adequate outlet for 22.0 square miles. Channel improvement "C" will increase the flows into North Salt Lake.

The total cost of the channel improvements is $1,274,952.

A lake level control structure will be installed at the outlet of North Salt Lake. A gate will be provided so that the lake can be managed for waterfowl use.

The lake level control structure will at times serve as a multiple-purpose flood prevention and wildlife structure. Because the flood prevention feature is not highly significant and the availability and frequency of use for flood prevention is not predictable, it is considered a single purpose wildlife feature.

The cost of the lake level control structure and the cost of land needed to develop the lake area for waterfowl use is estimated to be $38,939.

The structure locations shown on the watershed map are approximate locations. Final designs will dictate the exact locations of reservoir type structures and the beginning and termination of channel improvements.

Physical data for all structural measures are shown in Tables 3, 3A, etc.

Cost data for the structure are shown in Table 2.

EXPLANATION OF INSTALLATION COSTS

Total project installation costs are estimated at $1,991,870.

Estimated costs for installation of needed land treatment measures account for $272,230. Land owners and operators will furnish $198,827 in establishing land treatment. The Agricultural Stabilization and Conservation Service will share in this cost for approved practices.

Technical assistance costs associated with the installation of land treatment measures is estimated to be $73,053. The Soil Conservation Service will furnish $72,628 and $425 will be provided by the North Dakota Forest Service through the Cooperative Forest Management Program. The current rate of technical assistance available to the local Soil Conservation Districts will be continued during the project installation period at a cost of $25,675. Funds appropriated under the Watershed Protection and Flood Prevention Act will be used to accelerate the installation of land treatment measures by providing additional technical personnel to aid the Soil Conservation Districts. The cost of this additional technical assistance is estimated to be $47,378.

Estimated cost for installation of the structural measures is $1,719,640. This cost is based on planning designs. The planning designs are based on field survey data for the various structure sites. Unit costs based on bids received in other contracts are used to estimate contract costs.

The cost of land for easements and rights-of-way is based on current market value ($167 per acre, average).

Bridge costs computed for new bridges or needed modifications of existing structures are estimated at $116,905.

Quantities of earth to be excavated are determined for each channel reach and structure. Estimates are made for fill placement, spoil leveling, seeding, obstruction removal, etc. Costs for concrete and steel, needed gates, and appurtenances are included.

Costs for contingencies, administration of contracts, and installation services are based on actual costs for works of improvement that have been built in other watersheds in North Dakota.

The cost of retarding structure is allocated to the single purpose of flood prevention. The sponsors will furnish all costs of land, easements, and rights-of-way and administer the contract. The Service will furnish all of the construction cost and the installation services cost which includes engineering and other administrative cost.

The costs of channel improvement are allocated to flood prevention and drainage.

Channel improvement costs are first divided on the percentage of the dual problem area to the total problem area. The amount allocated to the dual problem area is divided 50 percent to drainage and 50 percent to flood prevention. The half allocated to flood prevention is added to the amount not allocated to the dual problem area to arrive at the total allocated to flood prevention.

The total installation cost for channel improvement is $1,274,952. The P.L. 566 cost is $965,457; the Other funds cost is $309,495.

The estimated obligation of total project funds for each fiscal year during the installation period is as follows:

Fiscal Year	PL 566	Other
First	51,336	159,970
Second	498,587	182,625
Third	209,740	103,136
Fourth	348,131	114,720
Fifth	273,495	50,130
Total	1,381,289	610,581

The expected sequence of installation is as follows: Second Fiscal Year - Lower Reach of Channel A; Third Fiscal Year - All of Channel C and North Salt Lake Control Structure; Fourth Fiscal Year - Floodwater Retarding Structure; Fifth Fiscal Year - Upper Reach of Channel A and all of Channel B.

Cost allocation and cost sharing determinations are explained in the investigation and analysis section (page 27) of this plan and costs are tabulated in Tables 1, 2, and 2A.

EFFECTS OF WORKS OF IMPROVEMENT

Investigations revealed the feasibility of one floodwater retarding structure site. The effects of the floodwater retarding structure are estimated to be as follows:

1. The cost of Channel A, 39 miles in length, is reduced $174,000. Savings are a result of less excavation, less cropland needed for rights-of-way, and fewer bridge replacements and modifications.

2. Five miles of meandering creek channel will have capacity to provide a satisfactory level of flood protection. Without the floodwater retarding structure this channel reach required realignment, excavation, bridge replacement and modification, and maintenance of the designed channel capacity after installation.

3. The floodwater retarding structure will reduce the overbank peak flow at a point upstream from the backwater effect of the mainstem.

4. Currently, part of the sediment pool area of the floodwater retarding reservoir is a marsh. Without the reservoir, induced damages from channel improvement upstream would develop to cropland adjacent to the marsh. Alleviation of that condition would require channel improvement through the marsh area which would eliminate the wetland condition. The structure will in effect preserve this marsh area and its present wildlife value.

5. Periodically, thick ice and quite rapid ice "break-up" cause damage. Ice jams cause ponding. Where these jams break up, velocities are higher than from summer storm runoff. Ice and floodwater damage bridges. Fences, including fence posts, are broken by the ice and floodwater. When streamflow is within the channel, banks are eroded by the floating ice. The floodwater retarding structure, controlling most of the upland runoff, will largely control the peak discharge that breaks up the thick ice that accumulated on the stream during long periods of below freezing weather. The slow release from the principal spillway will tend to melt the ice in place. The combination of reduced, controlled, and sustained flow will melt more of the ice in place.

The works of improvement will reduce the delay of seeding damage caused by snowmelt runoff and reduce the damage caused by flooding from summer rains. Based on analysis made in adjoining watershed with comparable conditions, it is estimated that crop and pasture damages will be reduced 67 percent by the structural works. In addition, it is estimated that land treatment will reduce present damages five percent.

Floodwater damages will be reduced or eliminated on a total of 22,500 acres of cropland. This will benefit 70 farm units.

The areas with soils classified as w_2 or f_2 have a dual problem of flooding and drainage. They are made up of shallow depressions of varying sizes occurring in a random pattern throughout the flood damage area. When the channel improvement is installed, the w_2 and f_2 areas will be provided with an outlet for on-farm drains, thus alleviating the drainage problem.

The water level control structure at the outlet of North Salt Lake will enhance the hunting of migratory waterfowl. The lake will also provide a nesting area for the waterfowl. There are 60,000 people living in North Dakota within 50 miles of this area so it will be readily available to a substantial number of hunters. With a good shooting area available for public hunting, the local business will increase for 1 to 2 months each fall. Businesses affected would be cafes, service stations, and lodging facilities. This should increase each successive year.

Secondary benefits stemming from the project are realized from transporting, processing, and marketing agricultural commodities produced as a result of reduced crop losses from flooding and inadequate drainage. Secondary benefits induced by the project include the increased net returns to suppliers of farm equipment and materials required to achieve the increased agricultural production made possible by the project and the increased net return to retailers and wholesalers from increased consumer expenditures by the farm family. Secondary benefits from a national viewpoint are not pertinent to the economic evaluation.

PROJECT BENEFITS

Total monetary benefits are $199,660 annually from the installation of the structural works of improvement for flood prevention and drainage. The largest portion, $172,843, comes from a reduction in floodwater damage. Annual benefits from drainage are $6,268. Secondary benefits are estimated at $20,549 and will accrue within the immediate zone of influence of the project.

The benefits from flood prevention accrue from a reduction in crop loss. The annual benefit to crops is $149,700.

Benefits from a reduction in other agricultural damages directly related to flood prevention are $7,485. Most of this comes from the control of noxious weeds spread by low velocity overland flows. A minor portion of the benefits are from reductions in damage to stored grain, hay, farmsteads, and removal of debris.

Benefits to roads and bridges were not evaluated monetarily. Indirect benefits are estimated at 10 percent of the direct benefits.

In addition to the annual monetary benefits supporting the annual costs of the project, there is a reduction in floodwater damage of $13,053 from the installation of land treatment measures.

Benefits to drainage were determined to be a percentage of the floodwater reduction benefits equal to the ratio of the costs allocated to drainage. Annual primary benefits from drainage are $6,268.

Associated costs, $2,084 for flood prevention and $76 for drainage, have been deducted from the benefits for the annual cost of on-farm surface field ditches.

Benefits accruing to the wildlife development were not monetarily evaluated.

COMPARISON OF BENEFITS AND COSTS

The total estimated structure cost for flood prevention and drainage is $1,680,701 (Table 2 and 2A). This cost, when amortized over a 50 year period at 3 percent interest, results in an annual equivalent cost of $65,328. The average annual cost of maintenance is estimated at $12,791. The total annual cost is $78,119 (Table 4). When the project is installed and operating, the estimated average annual primary benefits are $179,111 (Table 6). The ratio of the annual primary benefit to the annual cost is 2.3 to 1. The inclusion of secondary benefits results in a benefit cost ratio of 2.6 to 1 (Table 6).

The total estimated structure cost for wildlife development is $38,939. The annual cost amortized over 50 years at 3 percent interest is $1,514. The average annual cost of operation and maintenance is estimated at $144. The benefits from the wildlife development have not been monetarily evaluated and are therefore not included in benefit cost determinations.

PROJECT INSTALLATION

The project installation period is five years.

Farmers will apply land treatment measures in cooperation with their respective Soil Conservation Districts.

The Soil Conservation Service will provide technical assistance to the Soil Conservation Districts.

Further assistance will be provided in the installation of the land treatment phases of the program from the Agricultural Stabilization and Conservation Service, Extension Service, Farmers Home Administration and the North Dakota Forest Service.

Structural works of improvement will be installed through contracts let by the Pembina and (or) Walsh County Water Management Districts.

The sponsoring local organizations will acquire all land, easements and rights-of-way. The Water Management Districts have the right of eminent domain and will use this authority if necessary.

All contracts will be administered by the sponsoring organizations.

The Soil Conservation Service will provide installation services, to include engineering surveys, design of the structural works, preparing plans and specifications, construction inspection and administration.

FINANCING PROJECT INSTALLATION

Local organizations sponsoring the project are active and experienced in watershed operations and procedures.

The Soil Conservation Districts will encourage the acceleration of land treatment measures. The estimated cost of installing these measures is $272,230. The cost to land owners and operators is estimated to be $199,177. It is expected that they will be reimbursed for a portion of this cost through the Agricultural Conservation Program.

Table I shows the area of land programmed for treatment and the estimated cost of technical assistance for forestry to be furnished by the North Dakota Forest Service in cooperation with the U.S. Forest Service under the going Cooperative Forest Management program. The technical assistance for installing forestry measures will cost $425.

The present level of technical assistance amounting to $25,675 will be supplemented by P.L. 566 funds so that needed land treatment measures can be planned and applied during the installation period. Accelerated technical assistance to be provided by P.L. 566 funds is $47,378.

All structural works of improvement will be installed by the Pembina or Walsh County Water Management Districts. Funds for which the District is obligated will be raised by taxation in accordance with the North Dakota State Law governing Water Management Districts.

Other funds cost for the wildlife purpose will be furnished by the North Dakota State Game and Fish Department. Funds on hand derived from previous assessments plus future resources are expected to be adequate to meet the needs during the five year installation period. The sponsors do not anticipate using the loan provisions of the Act.

The Water Management Districts will obtain all land, easements and rights-of-way needed for structural measures. The North Dakota State Game and Fish Department will assist the concerned Water Management District in obtaining easements for the North Salt Lake development.

The Water Management Districts will let and administer all contracts and provide the funds for these purposes.

They will also provide the Other funds cost share for purposes other than flood prevention.

The State Game and Fish Department will reimburse them for the costs of wildlife development. All such assistance will be covered by agreements when final plans are made and prior to actual construction.

The sponsoring local organization which will award and administer the contract for measures included in a project agreement is the only sponsor required to sign the project agreement which includes these measures.

Total cost of all structural measures to be paid by Other funds is estimated to be $385,729.

Before Federal financial assistance for construction is furnished, all necessary land, easements, and rights-of-way must be secured or a written statement obtained from the responsible sponsoring organization that it is able and willing to obtain all land, easements, and rights-of-way by use of legal authority and (or) funds available to it.

When legal requirements have been met, the Soil Conservation Service will make available an estimated $1, 134,479 of P.L. 566 funds for the construction of the structural works of improvement. These funds will be furnished as needed and as they become available. The Soil Conservation Service will require an estimated $199,432 of P.L. 566 funds for installation services as noted in Table 1.

Federal assistance for carrying out the works of improvement as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Cong., 68 Stat. 666) as amended.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures for watershed protection will be installed, operated and maintained by land owners and operators under agreement with their respective Soil Conservation Districts. Representatives of the Soil Conservation Districts will make periodic inspections of the land treatment measures to determine maintenance needs and to encourage owners and operators to perform needed maintenance.

Forest Service woodland treatment measures will be maintained by landowners and operators with technical assistance provided by the North Dakota Forest Service in cooperation with the U.S. Forest Service under the going Cooperative Forest Management Program.

The Water Management Districts will be responsible for the maintenance of the structural measures for flood prevention and agricultural water management. The estimated annual cost is $12,791. The State Game and Fish Department will assist in the operation and maintenance of the structural works for wildlife. The estimated annual cost of operation and maintenance for this purpose is $144.

Operation and maintenance agreements will be executed for the structural measures prior to execution of project agreements and issuing the invitation to bid on construction contracts. These agreements will

be between the Soil Conservation Service and the Water Management District. The District will assume responsibility for operation and maintenance simultaneously with the acceptance of the construction from the contractor. Funds needed for maintenance will be obtained by taxation.

Inspection of the individual structures will be made annually and following flood producing storms. The inspections will be made by a committee composed of representatives of the sponsoring organizations and the Soil Conservation Service. Authorized representatives will have free access to inspect the structural works of improvement.

Items of inspection will include, but not be limited to, the condition of the structures and appurtenances, the vegetative cover, the need for control of vegetation to prevent any reduction of the capacity of the channels, and the accumulation of sediment. Reports will be prepared covering the inspection stating maintenance needed. The reports, together with a record of the action taken, will be kept on file by the Water Management Districts.

Operation and maintenance may be accomplished by contract or force account.

TABLE I - ESTIMATED PROJECT INSTALLATION COST

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

Installation Cost Item	Unit	Acres To Be Treated or Number	Estimated Cost (Dollars) 1/ P.L.566	Other	TOTAL
LAND TREATMENT					
Soil Conservation Service					
Cropland	ac.	38,329		198,827	198,827
Technical Assistance			47,378	25,250	72,628
SCS Subtotal			47,378	224,077	271,455
Forest Service					
Woodland	ac.	350		350	350
Technical Assistance				425	425
FS Subtotal				775	775
TOTAL LAND TREATMENT			47,378	224,852	272,230
STRUCTURAL MEASURES					
Soil Conservation Service					
Channel Improvement	mi.	56.1	824,726	14,690	839,416
Floodwater Retarding Structure	No.	1	304,160		304,160
North Salt Lake			5,593	5,594	11,187
Subtotal - Construction			1,134,479	20,284	1,154,763
Installation Services					
Soil Conservation Service					
Engineering Services			107,051		107,051
Other			92,381		92,381
Subtotal - Installation Services			199,432		199,432
Other Costs					
Land, Easements & R/W				362,945	362,945
Administration of Contracts				2,500	2,500
Subtotal - Other				365,445	365,445
TOTAL STRUCTURAL MEASURES			1,333,911	385,729	1,719,640
TOTAL PROJECT			1,381,289	610,581	1,991,870
SUMMARY					
Subtotal SCS			1,381,289	609,806	1,991,095
Subtotal FS				775	775
TOTAL PROJECT			1,381,289	610,581	1,991,870

1/Price Base 1963

Date: August 1964

TABLE 1A -- STATUS OF WATERSHED WORKS OF IMPROVEMENT

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

Measures	Unit	Applied To Date	Total Cost Dollars 1/
Land Treatment			
Crop Residue Use	Acre	35,017	42,020
Cover Cropping	Acre	9,347	24,302
Field Windbreaks	Feet	605,570	36,940
Drainage, Field Ditch	Feet	2,845,913	344,355
TOTAL			447,617

1/Price Base - 1963

Date: August 1964

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

(Dollars)[1/]

Structure Site Number or Name	Installation Cost - P.L. 566 Funds				Installation Cost - Other Funds				Total Installation Cost
		Installation Services				Other			
	Construction	Engineering	Other	Total P. L. 566	Construction	Adm.of Contracts	Easements & R/W	Total Other	
Channel A	641,354	41,861	52,222	735,437	11,424	500	172,330	184,254	919,691
Channel B	30,000	10,162	2,443	42,605	534	500	11,920	12,954	55,559
Channel C	153,372	21,555	12,488	187,415	2,732	500	109,055	112,287	299,702
Subtotal Channels	824,726	73,578	67,153	965,457	14,690	1,500	293,305[2/]	309,495	1,274,952
Dam No. 1	304,160	27,916	24,333	356,409		500	48,840	49,340	405,749
North Salt Lake	5,593	5,557	895	12,045	5,594	500	20,800	26,894	38,939
GRAND TOTAL	1,134,479	107,051	92,381	1,333,911	20,284	2,500	362,945	385,729	1,719,640

1/Price base 1963.

2/Includes $116,905 for bridges.

Date: August 1964

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

(Dollars)1/

Item	Purpose: Flood Prevention	Drainage	Fish & Wildlife	Total
COST ALLOCATION				
Channels A, B, & C	1,230,328	44,624		1,274,952
Dam No. 1	405,749			405,749
North Salt Lake Development			38,939	38,939
Total	1,636,077	44,624	38,939	1,719,640
COST SHARING				
P.L. 566	1,302,251	19,615	12,045	1,333,911
Other	333,826	25,009	26,894	385,729
Total	1,636,077	44,624	38,939	1,719,640

1/Price base 1963

Date: August 1964

TABLE 3 - STRUCTURE DATA

FLOODWATER RETARDING STRUCTURE

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

Item	Unit	Structure Number 1
Drainage Area	sq.mi.	18.9
Storage Capacity		
Sediment	ac.ft.	152
Floodwater	ac.ft.	2,488
Total	ac.ft.	2,640
Surface Area		
Sediment pool	ac.	45
Floodwater pool	ac.	410
Volume of Fill	cu.yds.	300,100
Elevation Top of Dam	ft.	997.8
Maximum Height of Dam	ft.	26.6
Emergency Spillway		
Crest Elevation	ft.	992.8
Bottom Width	ft.	250
Type		Earth
Per cent chance of use		4
Ave. Curve No. - Cond. II		78
Emergency spillway hydrograph		
Storm rainfall (6-hr.)	in.	3.8
Storm runoff	in.	1.6
Velocity of flow (V_c)	ft/sec	3.9
Discharge rate	c.f.s.	480
Max. w.s. elev.	msl	993.8
Freeboard hydrograph		
Storm rainfall (6-hr.)	in.	5.8
Storm runoff	in.	3.2
Velocity of flow (V_c)	ft/sec	6.9
Discharge rate	c.f.s.	2,550
Max. w.s. elev.	msl	995.4
Principal Spillway		
Capacity-low stage	c.f.s.	94
Capacity equivalents		
Sediment volume	in.	.15
Detention volume (net)	in.	2.47
Spillway storage	in.	3.72
Class of Structure		a

Date: August 1964

TABLE 3A - STRUCTURE DATA

GRADE STABILIZATION STRUCTURE

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

Station	Drainage Area 1/	Drop	Earth Fill	Concrete	Type Structure
	(sq.mi.)	(ft.)	(cu.yd.)	(cu.yd.)	
Channel A					
47+00	11.8	8.6	500	75.0	C
107+00	8.0	8.0	500	60.3	C
418+00	31.0	4.3	500	85.0	C
900+00	66.0	3.8	500	105.0	C
940+00	6.9	4.0	500	43.0	C
1335+00	95.0	7.5	500	115.0	C
1792+00	121.0	8.2	500	200.0	C
Channel B					
839+39	4.0	4.0	500	26.0	C
North Salt Lake Control Structure	22.0	2.5	7550	18.5	Rectangular Weir

1/Uncontrolled drainage area.

Date: August 1964

TABLE 3B - STRUCTURE DATA

CHANNELS

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

Channel Designation	Station Numbering For Reach Station (100ft.)	Station (100ft.)	Water-shed Area (sq.mi.)	Required Drainage Curve	Required Drainage Capacity (cfs)	Planned Channel Capacity (cfs)	Bottom Width (ft.)	Side Slope	Depth (ft.)	Grade (pct.)	Velocity in Channel (ft/sec)	Volume of Excavation (cu.yd.)
Channel A												
1 - 2	0+00	1,826+80	121	M	1,195	1,240	28	3:1	8.5	.04	2.7	1,311,700
2 - 3	0+00	211+00	11	M	244	251	12	4:1	4.5	.05	1.9	101,520
Channel B												
4 - 5	693+88	839+39	12	M	155	155	18	4:1	3.5	.035	1.4	49,620
6 - 7	88+00	172+00	4	M	64	71	12	4:1	2.9	.21	1.0	38,100
Channel C												
8 - 9	0+00	239+00	40	M	446	452	18	3:1	6.2	.035	2.0	220,400
10 - 11	5+00	462+30	22	M	271	274	50	3:1	3.6	.02	1.2	373,000

Date: August 1964

TABLE 4 - ANNUAL COST

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Channels A, B, C, and Dam No. 1	65,328	12,791	78,119
North Salt Lake (Wildlife)	(1,514)	(144)	(1,658)
TOTAL	65,328	12,791	78,119

1/Price base 1963; amortized @3 per cent interest for 50 years.

2/Long term projected prices.

Date: August 1964

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

(Dollars)1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefit
Floodwater			
Crops	226,046	63,293	162,753
Other Agricultural	11,302	3,164	8,138
Subtotal	237,348	66,457	170,891
Indirect	23,735	6,646	17,089
TOTAL	261,083	73,103	187,980

1/Long term projected prices.

Date: August 1964

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Willow Creek - Park River Watershed
Cavalier, Pembina and Walsh Counties, North Dakota

(Dollars)[1/]

Evaluation Unit	AVERAGE ANNUAL BENEFITS: Flood Prevention: Damage Reduction	AVERAGE ANNUAL BENEFITS: Agricultural Water Management: Drainage	AVERAGE ANNUAL BENEFITS: Secondary	AVERAGE ANNUAL BENEFITS: Total	Average Annual Cost	Benefit Cost Ratio
Multiple Purpose						
Dam No. 1 and Channel Improvement A, B, & C	172,843[2/]	6,268[3/]	20,549	199,660	78,119	2.6:1
Single Purpose Wildlife					(1,658)	

1/Costs - Price Base 1963; Benefits and O & M - Long term projected prices.

2/Associated costs of drainage $2,084 have been deducted. In addition it is estimated that land treatment measures will provide flood damage reduction benefits of $13,053 annually.

3/Associated costs of drainage $76 have been deducted.

Date: August 1964

INVESTIGATIONS AND ANALYSES

Hydrology and Hydraulics

The hydrology analysis for the Willow Creek-Park River Watershed consisted of a determination of storage for the floodwater retardation structure and a water yield for North Salt Lake Wildlife improvement.

Channel improvement for the disposal system is the same as for those that have been installed in the area. These systems are operating satisfactorily.

In the analysis of the floodwater retardation structure, the 25-year frequency snowmelt volume for the maximum 8-day runoff period of the Grafton gage was used for floodwater volume detention. The release was regulated to contain at least a 25-year frequency rainstorm runoff after 10 days of drawdown.

Design

All preliminary designs for the structures in this plan are based on sufficient field investigations to substantiate the site conditions and designs used for making cost estimates. Grades and velocities of the channels are based on cross sections and plotted profiles. See drawing of Typical Cross Section, Channel Improvement, following the Project Map.

Geology

Preliminary geologic investigations were made along the proposed channel improvements and at the proposed floodwater retarding structure.

Limited investigations included the erosion characteristics of the proposed channel bottom materials and the type of foundation and borrow materials that can be expected to be encountered during construction of the floodwater retarding structure.

Channels will be constructed in the glacial Lake Agassiz sediments which vary from highly erosive sands (SM and SP) in the upper reaches to heavy clays (CL and CH) in the lower reaches.

The floodwater retarding structure is located in an eroded portion of a broad sandy flat of what appears to be an extension of the Pembina Delta. Hand borings showed sandy (SP and SM) foundations, abutments and borrow materials. Water levels are high due to numerous beaver dams on the stream.

Detailed geologic investigation, including laboratory tests, will be made prior to preparation of final design to determine (1) stability of foundation strata, (2) suitability of materials for construction, (3) problems of high water-table and seepage control, and (4) common excavation.

Sedimentation

Sheet erosion occurs in the watershed on the steeper slopes, but delivery rates will be low. The sediment rate for the floodwater retarding structure is based on sediment production rates from five reservoirs which were surveyed adjacent to the watershed.

Field investigations and interviews indicate that partial scour and sediment deposition damages have occurred in the watershed at various times. The deposited sediment is usually fertile. The greater portion

of the sheet scour damage occurs during the higher frequency floods for which no level of protection can be afforded in this plan. These damages were not evaluated.

The major sediment problem is wind-blown material deposited in channels. Land treatment measures will be effective in reducing such accumulation.

Gully and stream bank erosion are not serious problems in the watershed and damages are considered negligible. Designed flow velocities will be maintained at less than three feet per second to prevent channel erosion.

Economics

A net income type of analysis was used in the economic justificatic of this watershed.

Field interviews were made with 32 farmers in the area to obtain the following (1) extent of floodplain, (2) present yields, (3) flood free yields to reflect the potential of that farm with present level of management, and (4) other damages, such as roads, bridges, erosion, sediment, etc.

The present yields reflect loss of production due to delay in seeding from snowmelt runoff floods and cropland inundation from summer floods. The flood free yields are those expected with a flood water disposal system installed under present level of management.

From the soil reconnaissance maps it was noted that there were four areas of major soil classifications in the floodplain-Ulen-Embden, Glyndon-Bearden, Fargo-Hegna, and Ulen-Arveson. Yields obtained by interview were tabulated according to the soil classifications to

establish present and flood free yields for these soil types. These flood free yields were substantiated by the North Dakota State University Soils Department personnel. Composite acre values were established for each area. Cost-return curves were drawn for each crop and net returns were calculated for present and future conditions in each area. By averaging the maximum floodplain and the present average annual acres flooded in similar type watersheds where the historical storm series was used in the analysis, the percentage of the present average annual acres flooded was determined for this watershed. It was determined that the present average annual acres flooded amounts to 57 per cent of the maximum floodplain.

The maximum floodplain of the Willow Creek-Park River Watershed was determined through field interviews. The maximum floodplain was planimetered by areas and reduced to 57 per cent to arrive at the average annual acres flooded in each area. These acres were multiplied by the composite net return per acre to arrive at present damages. The present damages were reduced 5 per cent by applying land treatment and 67 per cent for the structural program.

Small depressional areas are dispersed throughout the floodplain area. These areas sustain damages from both floodwater inundation and prolonged wetness, thus necessitating a dual purpose flood prevention and drainage channel for the depressional areas involved.

Soil Survey maps in Walsh County revealed that 16 per cent of the Fargo-Hegna soil series was mapped f_2 and w_2. From limited soil survey in Pembina County it was estimated that 10 per cent of the area

east of St. Thomas in the Bearden soil type was mapped f_2 and w_2. Two per cent of the lighter soils in the Glyndon and Ulen groups had f_2 or w_2 classifications. These percentages were weighted by the acreages involved to arrive at a seven per cent ratio of f_2 and w_2 lands in the floodplain to the total. Therefore, seven per cent of the installation cost of channels was allocated to the dual problem of flood prevention and drainage. Fifty per cent of this cost was allocated to flood prevention and fifty per cent to drainage. A breakdown of the cost allocation is shown in the table on page 33.

The associated costs for drainage amortized at 4 per cent amounts to $2,160 annually. These costs have been deducted from the average annual benefits. The local peoples' cost of construction for drainage in the project is $14,690.

A considerable amount of road and bridge damage has occurred in the watershed. These damages were not evaluated.

Current prices were used to estimate installation costs and long term prices were used in the economic evaluation. The value of land easements and rights-of-way was based on current market value plus acquisition costs. Operation and maintenance costs on the structural measures were based on long term projected prices.

Other agricultural damages were estimated at five per cent of the crop damages. These include loss of stored grain, damages to farm buildings, machinery, and extra cultural practices to control noxious weed infestation brought in by the floodwater.

Indirect damages were estimated to be 10 per cent of the direct flood damages. These include loss of production time, extra travel and delays in conducting farm operations and other business.

Secondary benefits to structural measures were computed in accordance with Watersheds Memorandum SCS-57. The value of local secondary benefits stemming from the project were considered to be 10 per cent of the direct primary structural benefits. The value of secondary benefits induced by the project were taken as 10 per cent of the increased costs that primary procedures will incur in connection with increased production.

Land Use and Treatment

A conservation program will be installed on private land based on the use of each acre of agricultural land within its capabilities and treatment in accordance with Soil Conservation Service technical standards for the area. Technical assistance provided from P.L. 566 funds will be used for the application of those measures which need to be accelerated beyond the going program rate. Measures to be installed under the land treatment program will have a significant effect in reducing runoff and sediment production or are necessary to realize the benefits.

The total amount of land treatment measures to be applied during the project period under going and accelerated programs, in addition to the measures already applied, will exceed the minimum requirements for application of land treatment measures called for under Public Law 566. Table I shows the acres that will be treated and the amounts for treatment and the technical assistance.

COST ALLOCATION AND COST SHARING

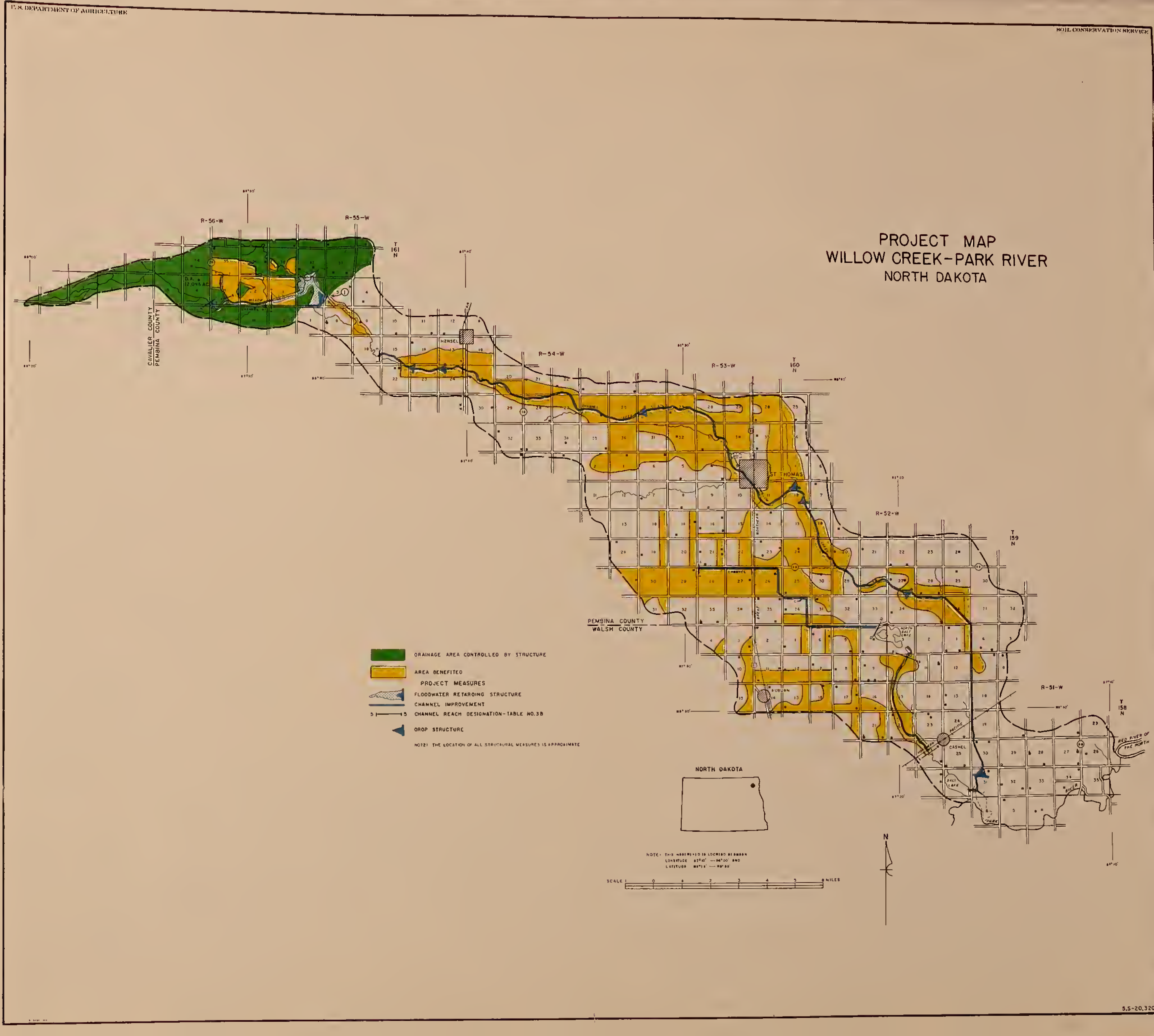
Channel Improvements A, B, and C

Item	Flood Prevention			Agricultural Water Management			Total	Total	Total
	P. L. 566	Other	Total	P.L. 566	Other	Total		P.L. 566	Other
Engineering Estimate	704,379		704,379	12,774	12,774	25,548	729,927	717,153	12,774
Contingencies	105,657		105,657	1,916	1,916	3,832	109,489	107,573	1,916
Total Construction	810,036		810,036	14,690	14,690	29,380	839,416	824,726	14,690
Installation Services Engineering Services	71,003		71,003	2,575		2,575	73,578	73,578	
Other	64,803		64,803	2,350		2,350	67,153	67,153	
Land, Easements & R/W		283,039	283,039		10,266	10,266	293,305		293,305
Adm. of Contracts		1,447	1,447		53	53	1,500		1,500
Total Installation Costs	945,842	284,486	1,230,328	19,615	25,009	44,624	1,274,952	965,457	309,495
Per Cent of Total			96.5			3.5	100.0		
Per Cent of Total Agricultural Water Management				44.0	56.0				

COST ALLOCATION AND COST SHARING

North Salt Lake Development

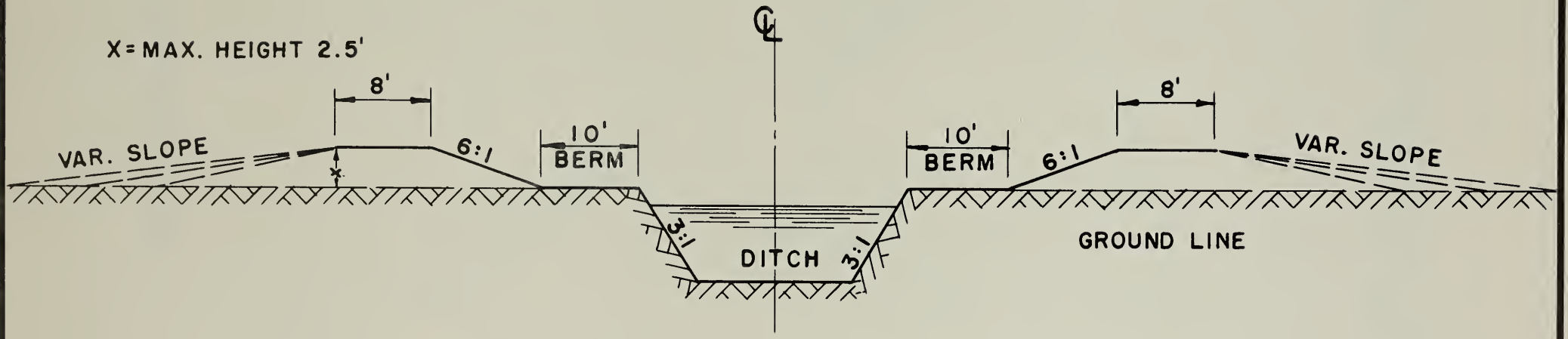
Item	Fish and Wildlife P.L. 566	Fish and Wildlife Other	Total
Engineering Estimate	4,864	4,864	9,728
Contingencies	729	730	1,459
Total Construction	5,593	5,594	11,187
Installation Services			
Engineering Services	5,557		5,557
Other	895		895
Land, Easements & R/W		20,800	20,800
Administration of Contracts		500	500
Total Installation Costs	12,045	26,894	38,939
Per Cent of Total	31.0	69.0	100.0


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PROJECT MAP
WILLOW CREEK-PARK RIVER
NORTH DAKOTA
R-56-W
R-55-W
R-54-W
R-53-W
R-52-W
R-51-W
T 161 N
T 160 N
T 159 N
T 158 N
CAVALIER COUNTY
PEMBINA COUNTY
PEMBINA COUNTY
WALSH COUNTY
HENSEL
ST THOMAS
AUBURN
CASHEL
RED RIVER OF THE NORTH
DRAINAGE AREA CONTROLLED BY STRUCTURE
AREA BENEFITED
PROJECT MEASURES
FLOODWATER RETARDING STRUCTURE
CHANNEL IMPROVEMENT
CHANNEL REACH DESIGNATION-TABLE NO.3B
DROP STRUCTURE
NOTE: THE LOCATION OF ALL STRUCTURAL MEASURES IS APPROXIMATE
NORTH DAKOTA
SCALE
MILES
N
5.5-20,320

March 5, 1958

USDA-SCS-LINCOLN NEBR. 1958

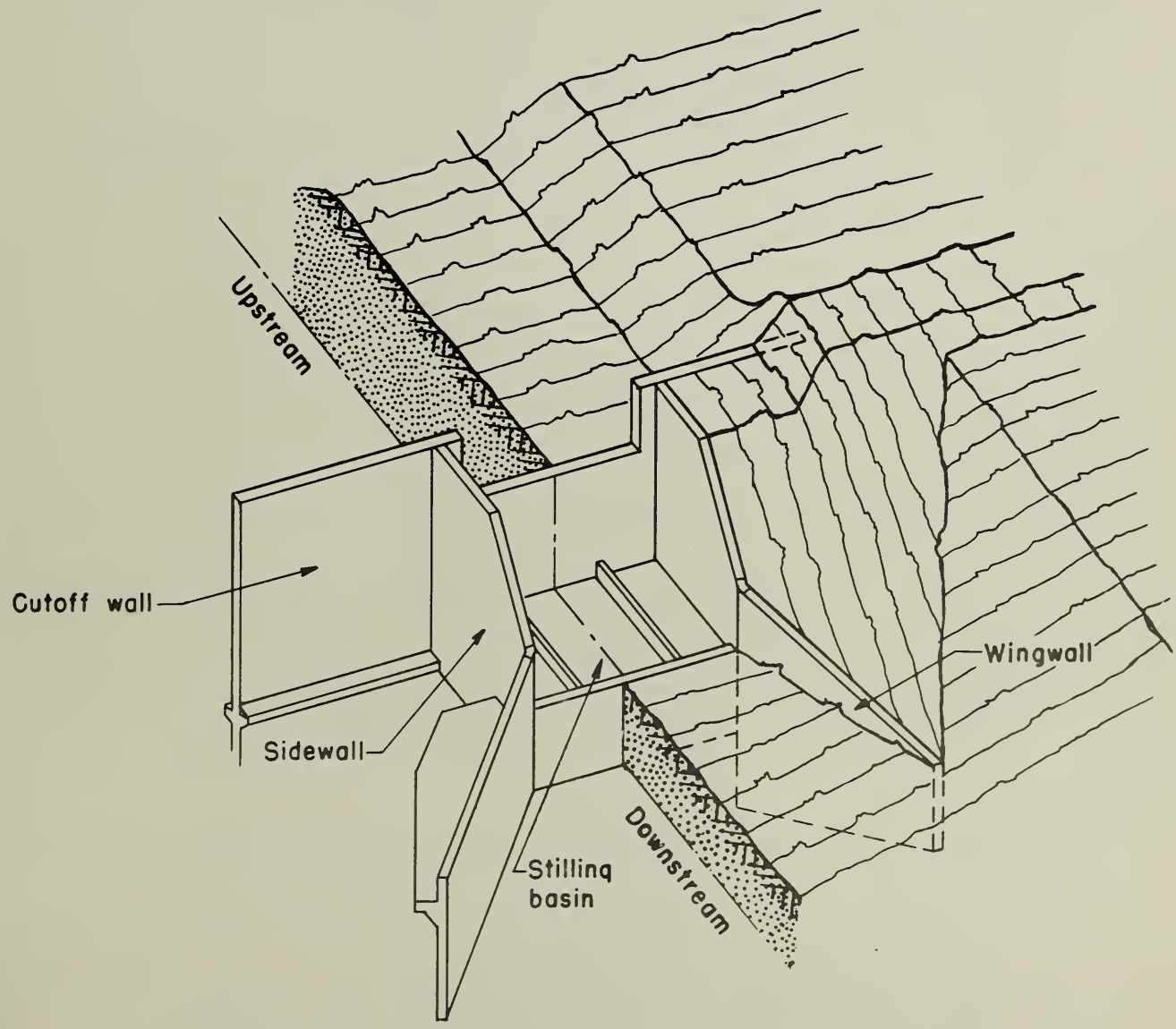
TYPICAL CROSS SECTION
FLOODWAY AND CHANNEL IMPROVEMENT



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

5-L-15,123

TYPICAL GRADE STABILIZATION STRUCTURE
CONCRETE DROP SPILLWAY

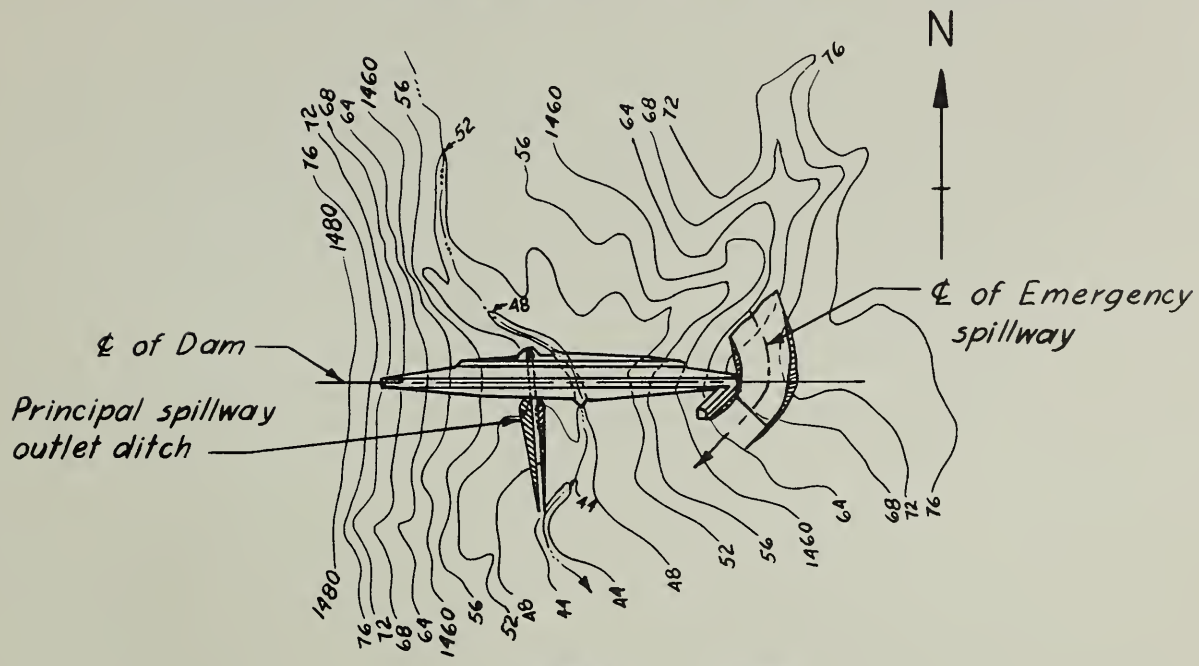


PERSPECTIVE VIEW

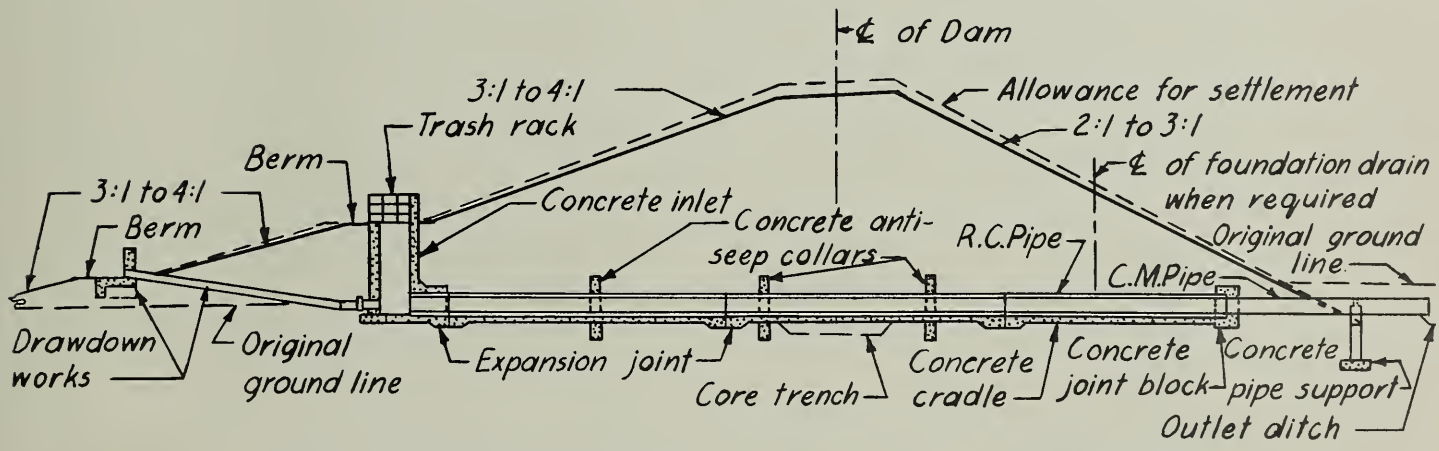
USDA-SCS-LINCOLN NEBR. 1958

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

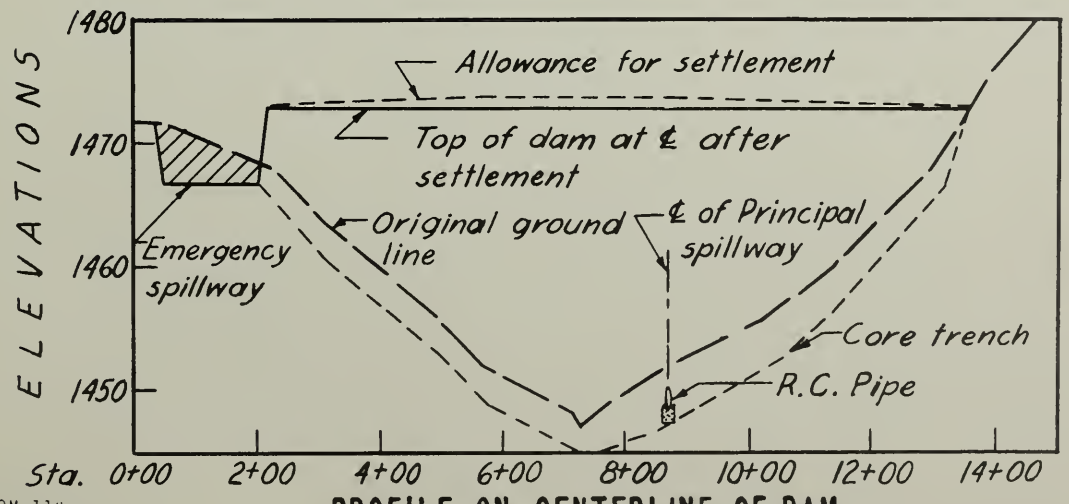
TYPICAL FLOODWATER RETARDING STRUCTURE



GENERAL PLAN



CROSS SECTION OF DAM ON CENTERLINE OF PRINCIPAL SPILLWAY



PROFILE ON CENTERLINE OF DAM

59M-114
USDA-SCS-LINCOLN NEBR 1958

5,L-15,520